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Date: 9-22-08

Application No.	:	**10/796,880**
Confirmation No.	:	**2504**
Appellant	:	**Yuan et al.**
Title	:	**A SYSTEM AND PROCESS FOR AUTOMATIC EXPOSURE CORRECTION IN AN IMAGE**
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Examiner	:	**S. V. Perungavoor**
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APPEAL BRIEF UNDER 37 CFR 41.37

I. REAL PARTY IN INTEREST

The subject application is assigned to Microsoft Corporation, One Microsoft Way, Redmond, WA, 98052.

II. RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences.

III. STATUS OF CLAIMS

1. Claims 1-30 represent all claims in the subject application as originally filed.
2. Claims 1-30 represent all claims currently pending in the subject application.
3. Claims 1-7, 10, 11, 21, 22, 24, 25, 27, 29 and 30 are rejected.
4. The rejection of claims 1-7, 10, 11, 21, 22, 24, 25, 27, 29 and 30 is appealed.

IV. STATUS OF AMENDMENTS

A first Office Action was issued on July 13, 2007 which rejected Claims 1-7, 10, 11, 21, 22, 24, 25, 27, 29 and 30. Subsequent to this first Office Action, amendments to the claims were filed under 37 CFR §1.111 on October 13, 2007. More particularly, Claims 24 and 26 were amended. A final Office Action was issued on April 25, 2008 which rejected Claims 1-7, 10, 11, 21, 22, 24, 25, 27, 29 and 30. No claim amendments were made in response to the final Office Action, however an after final response was filed on June 25, 2008.

An Advisory Action was issued on July 15, 2008 in response to the aforementioned after final response. The Advisory Action stated that the rejections of Clams 1-7, 10, 11, 21, 22, 24, 25, 27, 29 and 30 were continued.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The appealed claims include independent Claims 1 and 24. The subject matter of Claims 1 and 24 is explained hereafter by referring to selected portions of the Appellant's original application (hereafter simply referred to as the specification) and accompanying drawings.

V.1 Independent Claim 1

The subject matter of independent Claim 1 relates to a computer-implemented (refer to page 10, line 21 through page 11, line 9 of the specification, and FIG. 1, element

100) process for correcting the exposure of improperly exposed pixels of an image (refer to page 15, line 26 through page 16, line 2). A computer is used to perform the following process actions:

a) linearly expanding the dynamic range of the intensity levels of the image pixels so as to match the full dynamic intensity range available to a desired degree (refer to page 5, lines 15-24 and process action 302 of Fig. 3);

b) determining whether the linearly expanded intensity levels of the image pixels are evenly distributed (refer to page 6, lines 11-26 and process action 304 of Fig. 3); and

c) applying a correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel and evenly distributed intensity levels (refer to page 6, line 28 through page 8, line 25 and process actions 306 & 308 of Fig. 3), whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed (refer to page 17 lines 4-6).

V.2 Independent Claim 24

The subject matter of independent Claim 24 relates to a system for correcting the exposure of improperly exposed pixels of an image (refer to page 15, line 26 through page 16, line2) which includes a general purpose computing device (refer to page 10, line 21 through page 11, line 9 of the specification, and FIG. 1, element 100) and a computer program comprising program modules executable by the computing device (refer to page 11, lines 11-15). The computing device is directed by the program modules of the computer program to:

a) compute a histogram of the intensity levels of the image pixels (refer to page 17, lines 24-26);

b) compute the lowermost and uppermost intensity levels that are consistent with the overall distribution of intensity levels in the image (refer to page 17, line 26 through page 18, line 12);

c) compute new lowermost and uppermost intensity levels that span the full dynamic intensity range available to a desired degree (refer to page 18, line 24 through page 19, line 9);

d) employ the originally computed lowermost and uppermost intensity levels and the new lowermost and uppermost intensity levels to establish a linear intensity correction transform that maps the original intensity level of each pixel in the image to a linearly expanded intensity level (refer to page 19, line 21 through page 20, line 4);

e) apply the linear intensity correction transform to each pixel of the image (refer to page 19, line 21 through page 20, line 4);

f) determine whether the linearly expanded intensity levels of the image pixels are evenly distributed (refer to page 20, lines 7-12); and

g) applying a gamma correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel, whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed (refer to page 20, lines 12-13 and page 20, line 24 through page 25, line 9).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

a. The Final Office Action rejected independent Claim 1, and Claims 5, 6, 10 and 11, which are dependent on Claim 1, under 35 USC §102(b) as being anticipated by Lin, US Patent No. 5,812,286.

b. The Final Office Action also rejected independent Claim 24, and Claims 25, 27 and 30 which are dependent on Claim 24, under 35 USC §102(b) as being anticipated by Lin.

c. The Final Office Action further rejected Claims 2 and 3, which depend from independent Claim 1, under 35 USC §103(a) as being obvious over Lin in view of Hyodo, U.S. Patent No. 6,018,589.

d. The Final Office Action further rejected Claim 4, which depends from independent Claim 1, under 35 USC §103(a) as being obvious over Lin in view of Hyodo, and in further view of Iguchi et al., U.S. Patent Application Publication No. US 2001/0007599 (hereinafter Iguchi).

e. The Final Office Action further rejected Claim 7, which depends from independent Claim 1, under 35 USC §103(a) as being obvious over Lin in view of Gindele et al., U.S. Patent Application Publication No. US 2003/0228064 (hereinafter Gindele).

f. The Final Office Action further rejected Claim 21, which depends from independent Claim 1, under 35 USC §103(a) as being obvious over Lin in view of Liu et al., U.S. Patent Application Publication No. US 2004/0190789 (hereinafter Liu).

g. The Final Office Action further rejected Claim 22, which depends from independent Claim 1, under 35 USC §103(a) as being obvious over Lin in view of Liu, and in further view of Kuo et al., U.S. Patent No. 5,982,926 (hereinafter Kuo).

h. The Final Office Action further rejected Claim 29, which depends from independent Claim 24, under 35 USC §103(a) as being obvious over Lin in view of Liu.

VII. ARGUMENT

The following arguments present the rationale for the patentability of independent Claims 1 and 24 under 35 USC §102(b). The specific rejections of dependent Claims 5, 6, 10, 11, 25, 27 and 30 are not argued separately, as it is believed that the patentability of their independent parent Claims 1 and 24 negates the specific rejections advanced with respect to these dependent claims. The following arguments also present the rationale for the patentability of dependent Claims 2-4, 7, 21, 22 and 29 under 35 USC 103(a).

a. Rejection of Independent Claims 1 & 24 Under 35 USC §102(b):

Independent Claims 1 and 24 were rejected under 35 USC §102(b) based on the rationale that the Lin reference discloses each and every element of these claims. The Appellant respectfully suggests that Claims 1 and 24 are not anticipated by Lin for the following reasons.

The Examiner contended in the Final Office Action, via an incorporation by reference of the rejections made in the first Office Action, that with regard to Claim 1, Lin teaches:

> "linearly expanding the dynamic range of the intensity levels of the image pixels so as to match the full dynamic intensity range available to a desired degree **("The underlying assumption of stretching the histogram is that the point (R.sub.max, G.sub.max, and B.sub.max) corresponds to the white point of the image, and should be rendered as white in the RGB device space of a printer or a monitor. Similarly, the point (R.sub.min, G.sub.min, and B.sub.min) corresponds to the black point of the image, and should be rendered as black in the RGB device space of a printer or a monitor.", Column 2 Line 66)**; determining whether the linearly expanded intensity levels of the image pixels are evenly distributed **("a curve fit is performed for each histogram from the new maxima, minima, and median"; wherein the curve fit modifies the image only when the original image does not already fit the curve, i.e. when pixel levels are not evenly distributed; Column 3 Line 53)**; and whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed, applying a correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel and evenly distributed intensity levels **("As described in step 40, each pixel of the image data is mapped according to the gamma curve for each channel.", Column 3 Line 46)**.

The Examiner then added the following in the Final Office Action with regard to Claim 1:

> "Lin discloses the following: A computer-implemented process ***(i.e. fig. 1)*** for correcting the exposure of improperly exposed pixels of an image *[col. 1, ll. 48-50]*, comprising using a computer to perform the following process actions: linearly expanding ***(i.e. normalizing)*** the dynamic range of the

> intensity levels of the image pixels so as to match the full dynamic intensity range ***(i.e. R_{max}, G_{max}, B_{max}, R_{min}, G_{min}, and B_{min})*** available to a desired degree *[col. 2, ll. 53-67]*; determining whether the linearly expanded intensity levels of the image pixels are evenly distributed ***(i.e. whether there is no difference between the image value and gamma curve value) [col. 3, ll. 45-55]***; and whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed ***(i.e. there is a difference between the image value and gamma curve value)***, applying a correction factor ***(i.e. replacing the image value with the gamma curve value)*** to the linearly expanded intensity level ***(i.e. normalized)*** of each pixel in the image to produce a corrected intensity value for each pixel and evenly distributed intensity levels *[col. 3, ll. 45-55]*. Accordingly, Examiner maintains the rejection".

However, Claim 1 includes an element reading "linearly expanding the dynamic range of the intensity levels of the image pixels so as to match the full dynamic intensity range available to a desired degree". The Lin reference does not teach this element. The only time the Lin teachings result in a change to the intensity values of pixels in an image is in connection with step 40 (see Col. 3, lines 46-60 and Fig. 2). This step changes the color level of each color channel using a non-linear transform. This is evidenced by the curves shown in Fig. 7 which are used in look-up table form to change the color component of each pixel. Notice that the curves are not straight lines and so not linear.

Additionally, the Lin reference does not teach the claimed element reading "determining whether the linearly expanded intensity levels of the image pixels are evenly distributed". Nowhere in the Lin reference is the even distribution of pixel intensity values mentioned, or even suggested. Granted, the Examiner equates a curve fitting step of Lin to the claimed determination. More particularly, the Examiner states that the curve fitting modifies the image only when the original image does not already fit the curve, i.e., when pixel levels are not evenly distributed. However, the appellants claim "applying a correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel and evenly distributed intensity levels". This is done "whenever the linearly

expanded intensity levels of the pixels are determined not to be evenly distributed". This is inherently different than performing a curve fitting procedure that would allegedly result in no change when the pixel levels are evenly distributed. In the Examiner's scenario the image is always processed using the curve fitting step, regardless of whether the pixel levels are evenly distributed. This would result in a cost of processing and potential for the addition of noise to an image where no change is needed. In the claimed process, the foregoing is avoided by first "determining whether the linearly expanded intensity levels of the image pixels are evenly distributed", and then "applying a correction factor" whenever "the linearly expanded intensity levels of the pixels are determined not to be evenly distributed". Thus, the claimed process is clearly different from the Lin teachings, and has advantages not recognized in the reference.

The Examiner also implies that Lin's curve fitting procedure creates an equal distribution of intensity levels as claimed by the appellants. It is the appellants' position that this is not the case. Nowhere in the Lin reference is it suggested that its curve fitting procedure results in an equal distribution of pixel intensity levels.

Similarly, the Examiner contended in the Final Office Action, via an incorporation by reference of the rejections made in the first Office Action, that with regard to Claim 24, Lin teaches:

> "a system for correcting the exposure of improperly exposed pixels of an image, comprising: a general purpose computing device **("Microprocessor", Figure 1)**; a computer program comprising program modules executable by the computing device, wherein the computing device is directed by the program modules of the computer program to, compute a histogram of the intensity levels of the image pixels **("histogram", Column 2 Line 66)**, compute the lowermost and uppermost intensity levels that are consistent with the overall distribution of intensity levels in the image **("(R.sub.max, G.sub.max, and B.sub.max) corresponds to the white point of the image, and should be rendered as white in the RGB device space of a printer or a monitor. Similarly, the point (R.sub.min, G.sub.min, and**

B.sub.min) corresponds to the black point of the image", Column 3 Line 3), compute new lowermost and uppermost intensity levels that span the full dynamic intensity range available to a desired degree, and employ the originally computed lowermost and uppermost intensity levels and the new lowermost and uppermost intensity levels to establish a linear intensity correction transform that maps the original intensity level of each pixel in the image to a linearly expanded intensity level, apply the linear intensity correction transform to each pixel of the image **("stretching the histogram", Column 2 Line 66)**, determine whether the linearly expanded intensity levels of the image pixels are evenly distributed **(The designation is the outcome of equation 2)**, and whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed, employing a gamma correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel **(Equations 2 and 4)**.

The Examiner then added the following in the Final Office Action with regard to Claim 24:

"Lin discloses the following: A computer-implemented process ***(i.e. fig. 1)*** for correcting the exposure of improperly exposed pixels of an image *[col. 1, ll. 48-50]*, comprising using a computer to perform the following process actions: linearly expanding ***(i.e. normalizing)*** the dynamic range of the intensity levels of the image pixels so as to match the full dynamic intensity range ***(i.e. R_{max}, G_{max}, B_{max}, R_{min}, G_{min}, and B_{min})*** available to a desired degree *[col. 2, ll. 53-67]*; determining whether the linearly expanded intensity levels of the image pixels are evenly distributed ***(i.e. whether there is no difference between the image value and gamma curve value) [col. 3, ll. 45-55]***; and whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed ***(i.e. there is a difference between the image value and gamma curve value)***, applying a correction factor ***(i.e. replacing the image value with the gamma curve value)*** to the linearly

> expanded intensity level ***(i.e. normalized)*** of each pixel in the image to produce a corrected intensity value for each pixel and evenly distributed intensity levels *[col. 3, ll. 45-55]*. Accordingly, Examiner maintains the rejection".

Claim 24 include elements reading "establish[ing] a linear intensity correction transform that maps the original intensity level of each pixel in the image to a linearly expanded intensity level", and "apply[ing] the linear intensity correction transform to each pixel of the image". The Lin reference does not teach these elements. As stated previously, the only time the Lin teachings result in a change to the intensity values of pixels in an image is in connection with step 40 (see Col. 3, lines 46-60 and Fig. 2). This step changes the color level of each color channel usig a non-linear transform. This is evidenced by the curves shown in Fig. 7 which are used in look-up table form to change the color component of each pixel. Notice that the curves are not straight lines and so not linear.

Additionally, the Lin reference does not teach the claimed element reading "determine whether the linearly expanded intensity levels of the image pixels are evenly distributed". Nowhere in the Lin reference is the even distribution of pixel intensity values ever mentioned. Granted, as stated previously, the Examiner equates a curve fitting step of Lin to the claimed determination. More particularly, the Examiner states that the curve fitting modifies the image only when the original image does not already fit the curve, i.e., when pixel levels are not evenly distributed. However, the appellants claim "applying a gamma correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel". This is done "whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed". This is inherently different than performing a curve fitting procedure that would allegedly result in no change when the pixel levels are evenly distributed. In the Examiner's scenario, the image is always processed using the curve fitting step, regardless of whether the pixel levels are evenly distributed. This would result in a cost of processing and potential for the addition of noise to an image where no change is needed. In the claimed process, the foregoing is avoided because it is first "determine[d] whether the linearly expanded intensity levels of the image pixels are evenly

distributed", and then "applying a gamma correction factor" whenever "the linearly expanded intensity levels of the pixels are determined not to be evenly distributed". Thus, the claimed process is clearly different from the Lin teachings, and has advantages not recognized in the reference.

Here again, the Examiner also implies that Lin's curve fitting procedure creates an equal distribution of intensity levels as claimed by the appellants. As before, it is the appellants' position that this is not the case. Nowhere in the Lin reference is it suggested that its curve fitting procedure results in an equal distribution of pixel intensity levels.

Additionally, in the Advisory Action the Examiner further stated in regard to Claims 1 and 24 that:

> "Appellant argues, the "linearly expanding the dynamic range of the intensity levels of the image pixels so as to match the full dynamic intensity range available to a desired degree" is not met by the normalizing step of Lin [remarks page 4, para. 2, page 7, para. 3]. Examiner disagrees, Lin uses the normalization function to perform histogram stretching in order to expand the dynamic range to min and max points, see col. 2, ll. 60-67 also see the notice the difference between figs. 4 and 8. Appellant argues, that "determining whether the linearly expanded intensity levels of the image pixels are evenly distributed" and "whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed ..." is not disclosed [remarks page 6, para. 2, page 7, para. 4, page 8, para. 1]. Examiner disagrees the gamma curve represents what Lin considers to be a even distribution see col. 3, ll. 40-45. The appellant's argument regarding "whenever ..." is moot, since even if it is accepted that Lin does what the appellant says, it still meets the claim limitation, because it the claims does not state "only when".

With regard to the Examiner's contention that "Lin uses the normalization function to perform histogram stretching in order to expand the dynamic range to min and max points", this is clearly not the case. It is noted that the only maximum and minimum points

described in Lin are the R_{max}, G_{max}, B_{max}, R_{min}, G_{min}, and B_{min} points, which represent the existing intensity extremes of each of the RGB color channels. It is impossible to expand a dynamic range that extends from a maximum value to a minimum value, to that maximum and minumun value, as stated by the Examiner. "Linearly expanding the dynamic range of the intensity levels of the image pixels so as to match the full dynamic intensity range available" (as claimed by the appellant) necessarily involves the dynamic range being extended beyond at least one of the current maximum or minimum intensity values.

With regard to the Examiner's contention that "the gamma curve represents what Lin considers to be a even distribution see col. 3, ll. 40-45", this is also clearly not the case. The cited section of Line reads:

> "The number 0.4 is a user defined parameter that effects the brightness when the image is produced. A larger value results in a lighter image. The criteria is that processed images should have a good brightness and contrast on the monitor and printer. However, once chosen, this value is used to process all images".

There is absolutely nothing in this quoted passage that would equate a "good brightness and contrast on the monitor and printer" to the claimed "evenly distributed intensity levels".

In addition, the Examiner contended that ""whenever ..." is moot, since even if it is accepted that Lin does what the appellant says, it still meets the claim limitation, because it the claims does not state "only when"". In its generic form, the phase under contention would read--whenever something occurs, this action is taken. The Examiner would interpret this to mean--whenever something occurs, this action is taken, but whenever the something does not occur, the same action is still taken. Such an interpretation would render the "whenever" clause meaningless. Thus, the Examiner is imparting an unreasonable and unsupportable interpretation to the term "whenever". The claimed phase "whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed, applying a correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel and evenly

distributed intensity levels" must be interpreted as precluding the application of the correction factor when the linearly expanded intensity levels of the pixels are determined to be evenly distributed. This is not taught in Lin.

A prima facie case of anticipation is established only when the Examiner can show that the cited reference teaches each of the claimed elements of a rejected claim. In this case, the Examiner cannot show that the Lin reference teaches the claimed establishing, applying, determining and application features. Thus, the rejected claims recite features that are not taught in cited art, and as such a prima facie case of anticipation cannot be established. Accordingly, it is respectfully requested that the rejection of independent Claims 1 and 24 (and so likewise dependent Claims 5, 6, 10, 11, 25, 27 and 30) under 35 USC 102(b) over Lin be overturned based on the novel claim language:

> "linearly expanding the dynamic range of the intensity levels of the image pixels so as to match the full dynamic intensity range available to a desired degree; determining whether the linearly expanded intensity levels of the image pixels are evenly distributed; and whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed, applying a correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel and evenly distributed intensity levels" (as exemplified in Claim 1); and
>
> "employ the originally computed lowermost and uppermost intensity levels and the new lowermost and uppermost intensity levels to establish a linear intensity correction transform that maps the original intensity level of each pixel in the image to a linearly expanded intensity level, apply the linear intensity correction transform to each pixel of the image, determine whether the linearly expanded intensity levels of the image pixels are evenly distributed, and whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed, applying a gamma correction factor to the linearly expanded intensity level of each pixel in the image to

produce a corrected intensity value for each pixel" (as exemplified in Claim 24).

b. Rejection of Dependent Claims 2-4, 7, 21 and 22 Under 35 USC §103(a):

Claims 2 and 3 were rejected under 35 USC §103(a) as being obvious over Lin in view of Hyodo. Claim 4 was rejected under 35 USC §103(a) as being obvious over Lin in view of Hyodo, and in further view of Iguchi. Claim 7 was rejected under 35 USC §103(a) as being obvious over Lin in view of Gindele. Claim 21 was rejected under 35 USC §103(a) as being obvious over Lin in view of Liu. And finally, Claim 22 was rejected under 35 USC §103(a) as being obvious over Lin in view of Liu, and in further view of Kuo. It was contended in the final Office Action that the combined teachings of Lin and the other cited references respectively teach all the elements of the rejected claims, and that it would have been obvious to incorporate these teachings into Lin to produce the appellants' claimed invention. The appellants hereby respectfully disagree with the contentions of obviousness identified above because, like Lin, none of the other cited references teaches the aforementioned claimed linear expansion, determining and application features.

In order to deem the appellant's claimed invention unpatentable under 35 USC §103, a prima facie showing of obviousness must be made. To make a prima facie showing of obviousness, all of the claimed elements of an appellant's invention must be considered, especially when they are missing from the prior art. If a claimed element is not taught in the prior art and has advantages not appreciated by the prior art, then no prima facie case of obviousness exists. The Federal Circuit court has stated that it was error not to distinguish claims over a combination of prior art references where a material limitation in the claimed system and its purpose was not taught therein (*In Re Fine*, 837 F.2d 107, 5 USPQ2d 1596 (Fed. Cir. 1988)).

The cited combinations lack a teaching of the appellants' aforementioned claimed linear expansion, determining and application features. The cited combinations also fail to recognize the advantage of creating an image whose pixel intensities are evenly distributed and fill the full dynamic range available. Thus, the appellants have claimed a feature not

taught in the cited combinations, and which has advantages not recognized therein. Accordingly, no prima facie case of obviousness can be established in accordance with the holding of *In Re Fine*. This lack of a prima facie showing of obviousness means that the rejected claims are patentable under 35 USC §103(a). It is, therefore, respectfully requested that the rejection of Claims 2-4, 7, 21 and 22 be overturned based on the following non-obvious claim language exemplified in Claim 1 (from which all these claims ultimately depend):

> "linearly expanding the dynamic range of the intensity levels of the image pixels so as to match the full dynamic intensity range available to a desired degree; determining whether the linearly expanded intensity levels of the image pixels are evenly distributed; and whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed, applying a correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel and evenly distributed intensity levels".

c. <u>Rejection of Dependent Claim 29 Under 35 USC §103(a)</u>:

Claim 29 was rejected under 35 USC §103(a) as being obvious over Lin in view of Liu. It was contended in the Office Action that Lin teaches all the elements of the rejected claims with the exception of the claimed gamma correction feature. However, it was further contended that this feature is taught in Liu. Thus, it was concluded that it would have been obvious to incorporate the teachings of Liu into Lin to produce the appellants' claimed invention. The appellants respectfully disagree with this contention of obviousness because, like Lin, Liu does not teach the aforementioned claimed establishing, applying, determining and application features.

Thus, the appellants have claimed features not taught in the cited combination, and which has advantages not recognized therein as described previously. Accordingly, no prima facie case of obviousness can be established in accordance with the holding of *In Re Fine*. This lack of a prima facie showing of obviousness means that the rejected claim is patentable

under 35 USC §103(a). It is, therefore, respectfully requested that the rejection of Claim 29 be overturned based on the following non-obvious claim language exemplified in Claim 24 (from which this claim ultimately depends):

> "employ the originally computed lowermost and uppermost intensity levels and the new lowermost and uppermost intensity levels to establish a linear intensity correction transform that maps the original intensity level of each pixel in the image to a linearly expanded intensity level, apply the linear intensity correction transform to each pixel of the image, determine whether the linearly expanded intensity levels of the image pixels are evenly distributed, and whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed, applying a gamma correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel".

VIII. CLAIMS APPENDIX

The claims listed below provide a complete copy of all claims involved in the Appeal:

Listing of Claims:

1. A computer-implemented process for correcting the exposure of improperly exposed pixels of an image, comprising using a computer to perform the following process actions:

linearly expanding the dynamic range of the intensity levels of the image pixels so as to match the full dynamic intensity range available to a desired degree;

determining whether the linearly expanded intensity levels of the image pixels are evenly distributed; and

whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed, applying a correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel and evenly distributed intensity levels.

2. The process of Claim 1, wherein the process action of linearly expanding the dynamic range of the intensity levels of the image pixels so as to match the full dynamic intensity range available to a desired degree, comprises an action of varying the degree to which intensity levels of the image pixels are made to match the full dynamic intensity range available between expanding the dynamic range of the intensity levels to match the full dynamic intensity range available to no expansion at all, depending on the value of a safeness parameter.

3. The process of Claim 2, wherein the safeness parameter is prescribed.

4. The process of Claim 2, wherein the safeness parameter is user-specified.

5. The process of Claim 1, wherein the process action of linearly expanding the dynamic range of the intensity levels of the image pixels, comprises the actions of:

computing a histogram of the intensity levels of the image pixels;

computing the lowermost and uppermost intensity levels that are consistent with the overall distribution of intensity levels in the image;

computing new lowermost and uppermost intensity levels that span the full dynamic intensity range available to a desired degree, and

employing the originally computed lowermost and uppermost intensity levels and the new lowermost and uppermost intensity levels to establish a linear intensity correction transform that maps the original intensity level of each pixel in the image to a linearly expanded intensity level;

applying the linear intensity correction transform to each pixel of the image.

6. The process of Claim 5, wherein the process action of computing the lowermost and uppermost intensity levels which are consistent with the overall distribution of intensity levels in the image, comprises the actions of:

computing the lowermost level as the level wherein,

the sum of the number of pixels exhibiting a level within a prescribed range of levels extending from lowest level possible to the unknown lowermost level, less one level, is less than the total number of pixels in the image multiplied by a tolerance factor designed to eliminate the impact of noise on the pixels intensity values, and

the sum of the number of pixels exhibiting a level within a prescribed range of levels extending from lowest level possible to the unknown lowermost level, is greater than or equal to the total number of pixels in the image multiplied by the tolerance factor; and,

computing the uppermost level as the level wherein,

the sum of the number of pixels exhibiting a level within a prescribed range of levels extending from the unknown uppermost level to the highest level possible is greater than or equal to the total number of pixels in the image multiplied by said tolerance factor, and

the sum of the number of pixels exhibiting a level within a prescribed range of levels extending from the unknown uppermost level, plus one level, to the highest level possible is less than the total number of pixels in the image multiplied by the tolerance factor.

7. The process of Claim 5, wherein the process action of linearly expanding the dynamic range of the intensity levels of the image pixels so as to match the full dynamic intensity range available to a desired degree, comprises an action of varying the degree to which intensity levels of the image pixels are made to match the full dynamic intensity range available between expanding the dynamic range of the intensity levels to match the full dynamic intensity range available to no expansion at all, depending on the value of a safeness parameter.

10. The process of Claim 1, wherein the process action of determining whether the linearly expanded intensity levels of the image pixels are evenly distributed, comprises the actions of:

computing a histogram from the linearly expanded pixel intensity levels;

computing a 50 percentile (i.e., median) intensity level from the linearly expanded pixel intensity level histogram as the level wherein,

the sum of the number of pixels exhibiting a level within a prescribed range of levels extending from lowest level possible to the unknown median level, less one level, is less than the total number of pixels in the image multiplied by 0.5, and

the sum of the number of pixels exhibiting a level within a prescribed range of levels extending from lowest level possible to the unknown median level, is greater than or equal to the total number of pixels in the image multiplied by 0.5;

determining if the difference between the median intensity level and one half the maximum intensity level is less than or equal to the maximum intensity value multiplied by an intensity tolerance factor designed to compensate for the impact of noise on the pixels intensity levels; and

whenever it is determined that said difference is not less than or equal to said product, designating that the linearly expanded intensity levels of the image pixels are not evenly distributed.

11. The process of Claim 1, wherein the process action of applying a correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel and evenly distributed intensity levels, comprises

the actions of:

computing a nonlinear gamma correction factor; and

applying the gamma correction factor to the linearly expanded pixel intensity level of each pixel in the image.

21. The process of Claim 11, wherein the process action of applying the gamma correction factor to the linearly expanded pixel intensity level of each pixel in the image, comprises an action of applying the gamma correction factor to each linearly expanded pixel intensity value such that $\hat{I} = \left(\frac{I}{L-1}\right)^{\gamma}(L-1)$, wherein $\hat{I}$ is the corrected pixel intensity value, I is the linearly expanded pixel intensity value, γ is the correction factor, and L is the maximum possible intensity level.

22. The process of Claim 21, further comprising a process action of, whenever the application of a gamma correction factor to the linearly expanded intensity level of each pixel in the image results in an overall brightening of the image, boosting the color saturation levels of each color channel of each pixel of the image by a desired amount.

24. A system for correcting the exposure of improperly exposed pixels of an image, comprising:

a general purpose computing device;

a computer program comprising program modules executable by the computing device, wherein the computing device is directed by the program modules of the computer program to,

compute a histogram of the intensity levels of the image pixels,

compute the lowermost and uppermost intensity levels that are consistent with the overall distribution of intensity levels in the image,

compute new lowermost and uppermost intensity levels that span the full dynamic intensity range available to a desired degree, and

employ the originally computed lowermost and uppermost intensity levels and the new lowermost and uppermost intensity levels to establish a linear intensity

correction transform that maps the original intensity level of each pixel in the image to a linearly expanded intensity level,

apply the linear intensity correction transform to each pixel of the image,

determine whether the linearly expanded intensity levels of the image pixels are evenly distributed, and

whenever the linearly expanded intensity levels of the pixels are determined not to be evenly distributed, applying a gamma correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel.

25. The system of Claim 24, further comprising a program module for, whenever the application of a gamma correction factor to the linearly expanded intensity level of each pixel in the image results in an overall brightening of the image, boosting the color saturation levels of each color channel of each pixel of the image by a desired amount.

27. The system of Claim 24, wherein the program module for employing a gamma correction factor to the linearly expanded intensity level of each pixel in the image to produce a corrected intensity value for each pixel, comprises sub-modules for:

computing a nonlinear gamma correction factor; and

applying the gamma correction factor to the linearly expanded pixel intensity level of each pixel in the image.

29. The system of Claim 27, wherein the sub-module for applying the gamma correction factor to the linearly expanded pixel intensity level of each pixel in the image, comprises an action of applying the gamma correction factor to each linearly expanded pixel intensity value such that $\hat{I} = \left(\frac{I}{L-1}\right)^{\gamma}(L-1)$, wherein $\hat{I}$ is the corrected pixel intensity value, I is the linearly expanded pixel intensity value, γ is the correction factor, and L is the maximum possible intensity level.

30. A computer-readable medium having computer-executable instructions for performing the process actions recited in Claim 1.

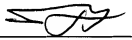
IX. EVIDENCE APPENDIX

NONE

X. RELATED PROCEEDINGS APPENDIX

NONE

Respectfully submitted,



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